

$$\Theta = T - T_m$$

$$\frac{d\Theta}{dt} = \frac{dT}{dt}$$

$$\frac{d\Theta}{\Theta} = -\frac{3h}{\rho c_p R} dt$$

$$\ln \Theta = -\frac{3ht}{\rho c_p R} + \ln c$$

$$\Theta(t) = c e^{-\frac{3ht}{\rho c_p R}}$$

$$T - T_m = (T_0 - T_m) e^{-\frac{3ht}{\rho c_p R}}$$

$$T(t) = T_m + (T_0 - T_m) e^{-\frac{3ht}{\rho c_p R}}$$

$$\frac{T(t) - T_m}{T_0 - T_m} = e^{-\frac{3ht}{\rho c_p R}}$$

$$\rho c_p \frac{\partial T}{\partial t} = \frac{k}{r^2} \frac{\partial}{\partial r} \left(r^2 \frac{\partial T}{\partial r} \right)$$

$$-k \frac{\partial T}{\partial r} = h(T - T_m)$$

$$T(r, 0) = T_0$$

$$T_{av}(t) = \frac{\int T dv}{V}$$

$$T_{av}(t) = \frac{\int_0^R T(r, t) 4\pi r^2 dr}{\frac{4}{3} \pi R^3}$$

$$\int_0^R 4\pi r^2 \rho c_p \frac{\partial T}{\partial t} dr = \int_0^R 4\pi r^2 \frac{k}{r^2} \frac{\partial}{\partial r} \left(r^2 \frac{\partial T}{\partial r} \right) dr$$

$$\rho c_p \frac{\partial}{\partial t} \int_0^R T(r, t) 4\pi r^2 dr = 4\pi k \left(r^2 \frac{\partial T}{\partial r} \right) \Big|_0^R$$

$$\rho c_p \frac{4\pi R^3}{3} \frac{dT_{av}}{dt} = 4\pi k R^2 \frac{\partial T}{\partial r} \Big|_{r=R}$$

$$\rho c_p \frac{4\pi R^3}{3} \frac{dT_{av}}{dt} = -4\pi R^2 h(T(R, t) - T_m) \quad ; \quad T(R, t) \cong T_{av}(t)$$

$$Bi = \frac{hR}{k} < 0,1$$